# HYDROLOGIC REPORT

FOR

# GENERAL MOTORS

# DESERT PROVING GROUND

# RIDE & STRUCTURE DEVELOPMENT ROAD


ELLIS, MURPHY & HOLGATE
Consulting Engineers
6601 N. Black Canyon Highway
Phoenix, Arizona 85015

March 1976

EM&H #4876

ellis, murphy, holgate & johnson
6601 N. Black Canyon Hwy., Phoenix, Arizona 85015 (602)242-4411



April 1, 1976

Mr. Charles Burm, Plant Services Manager
General Motors Desert Proving Ground
P.O. Box 1506
Mesa, Arizona 85201

Re: Hydrology Report
GM Desert Proving Ground
Ride & Structure Development
Road

Dear Mr. Burm:

We are pleased to submit herewith our Hydrology Report for the General Motors Proving Ground.

This report contains a hydrologic analysis for the area and a review of all known conditions that may have an influence on the construction of the new Ride and Structure Development Road. A summary statement and exhibit presents a suggested storm drainage system to protect the new facility.

We appreciate this opportunity to serve your needs.

Very truly yours,

ELLIS, MURPHY, & HOLGATE

Charles Edman, P.E.
Project Manager

CE/dw
Encl.

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# INDEX

# INTRODUCTION

The purpose of this report is to determine storm runoff quantities at existing points of concentration for the hydraulic design of facilities to protect the Ride and Structure Development Road and Access Road to be constructed at the General Motors Desert Proving Ground.

Basic information for the report, in addition to site and area inspection, was obtained from County 1/, State 2/ and Federal 3/ government agencies engaged in flood control and construction projects within the study area. This information was in the form of reports, maps and aerial photographs. Discussions with personnel of these agencies was informative regarding design data and function of existing works such as the Vineyard Road and Powerline Dams. Criteria and design concepts for the Superstition Freeway and Central Arizona Project Aqueduct were also made available.

Services rendered by these agencies have been invaluable in the preparation of this report and have provided the means for a more accurate evaluation of storm runoff than would otherwise be possible.

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1/ Flood Control District of Maricopa County
Maricopa County Highway Department

2/ Arizona Department of Transportation, Highways Division
Highway Plan Service
Photogrammetry & Mapping Service

3/ United States Department of Agriculture
Soil Conservation Service
United States Department of the Interior
Bureau of Reclamation - Central Arizona Project

# DRAINAGE AREA

## I. GENERAL DESCRIPTION

The drainage area extends northeasterly from the Proving Ground to Southern Avenue on the north and to Powerline Dam and Floodway on the east. There are 5,643 acres (8.8 sq. mi.) within the drainage area outside the Proving Ground. An additional 399 acres (0.6 sq. mi.) lying above Southern Avenue were included within the total study area, but considered noncontributing since runoff is retained by a private dam. The Powerline Dam and Floodway, planned by the Soil Conservation Service to retard and control a 100-year frequency storm, was constructed by the Flood Control District of Maricopa County during 1966 - 1969 and has eliminated all of the runoff from Weekes Wash and Siphon Draw above the dam which previously flooded the northern area of the Proving Ground.

The total drainage area has been divided into six separate areas that contribute runoff at different locations on the perimeter. The extent of these areas was determined from aerial photos. They are shown on Exhibit A and B and summarized in the report.

The drainage area is virtually untouched by development of any kind. Although several meandering unimproved roads traverse the area, the only improved dirt road is Vineyard which crosses the eastern extremity of the area. These roads have little effect upon the overall flow.

There are existing small dams and diversion dikes constructed on major washes which, if maintained, would eliminate some areas from contributing to runoff. Since continued maintenance is an unknown factor, only one area (Area IIa) has been considered noncontributing.

The General Soil Maps of Maricopa and Pinal Counties prepared by the Soil Conservation Service in 1973 classifies the soil in the area as the Gilman-Estrella-Avondale Association. The soil is very hot and dry and consists of deep loam and clay loam soils. It is rated as moderate in permeability, having a numerical range of 0.6 to 2.0 inches per hour. For the purpose of estimating runoff potential, the soil is classified as hydrologic soil Group B.

The natural vegetation common to this soil association is creosote bush, cactus, annual grasses and forbs with a scattering of mesquite and palo verde trees. The density of vegetative cover is considered to be 10% by study of aerial photographs and site inspection.

The ground slopes to the southwest and west with varying gradients of 0.56% to 0.84%. Quadrangle Maps published by the U.S. Geological Survey and aerial photographs were combined to calculate elevation differences and length of drainage areas.

The drainage pattern is fairly well defined in most instances, consisting of relatively shallow washes in a typical fan-type topography. When the capacity of the washes is exceeded overflow occurs and flooding becomes sheet flow.. Minor obstructions can easily change its direction and depth.

To determine the present capacity of each of the two major washes entering the northern perimeter of the Proving Ground, cross sections were taken at representative points and their capacity calculated as shown in Figure 1. It is obvious that these washes will not carry runoff of the magnitude generated by 25 to 50 year frequency storms and that sheet flow will occur.

## II. EFFECT OF PROPOSED MAJOR DEVELOPMENTS

The Superstition Freeway 1/ will be located midway between Baseline Road and Southern Avenue. East of the CAP Aqueduct crossing the freeway will be elevated 4 to 5 feet. The present planning concept indicates that structures will maintain the existing drainage patterns wherever possible. Due to the depression of the crossroads, some pumping and local channelization will be required. The target date for construction of the segment of the freeway from Ellsworth Road to U.S. 60 has been tentatively set for 1980 - 1981.

The proposed alignment of the CAP Aqueduct 2/ traverses the drainage area from northwest to southeast. It will cross all of the washes. CAP engineers have indicated that structures will be designed to maintain present flow in existing major washes. Construction of this reach of the aqueduct is expected to begin in 1979 and to be completed in 1981.

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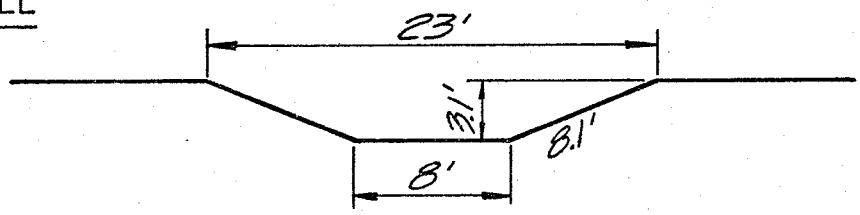
1/ Design Concept Report for Superstition Freeway, Arizona Department of Transportation, Highways Division Highway Plans

2/ CAP Location Maps and Alignment Data

## WEST CHANNEL




S = 0.011 ft./ft.; n = 0.035

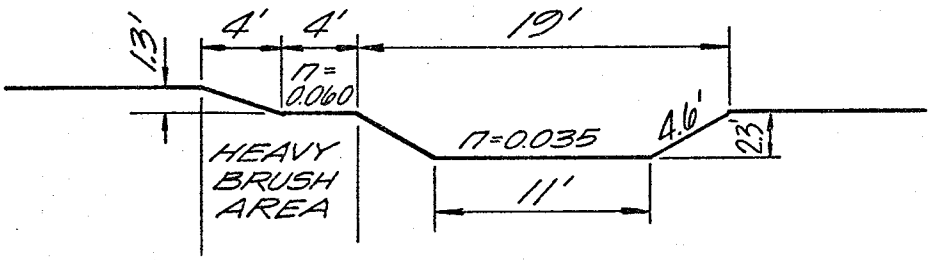
a = 48.05 sf; p = 24.23 ft.

R = a/p = 1.98

$Q = a\left(\frac{1.486}{n}\right) R^{2/3} S^{1/2} = 338$ cfs

*NOTE: THE TOPS OF ALL 3 - 43" x 27" PIPES ARE NEAR OR BELOW THE LEVEL OF THE SAND BUILDUP IN THE WASH RENDERING THEM INEFFECTIVE.*

## EAST CHANNEL




S = 0.0023 ft./ft.; n = 0.035

a = 43.70 sq. ft.; p = 20.23 ft.

R = a/p = 2.16

$Q = a\left(\frac{1.486}{n}\right) R^{2/3} S^{1/2} = 149$ cfs *

* Main channel only

FIGURE 1

These projects very likely will be followed, if not preceded, by urban growth--particularly adjacent to the freeway, changing land use from desert to subdivisions, shopping centers and other developments. This normally would increase peak discharge rates. However, such improvements will be subject to storm drain regulation by Maricopa County which requires onsite retention so that the peak discharge from the area will not be changed. The land in the drainage area is presently zoned Rural-43, restricted to one acre residential lots.

# HYDROLOGIC DESIGN METHOD

The Soil Conservation Service design method based on recorded rainfall data and drainage area characterists has been used to determine runoff. Since the study area is less than 10 square miles, design procedures outlined in Part I of the design method were applied.

The following is a review of these procedures and data sources as they relate to this report.

## I. DESIGN FREQUENCY

The design frequency was not predetermined in order that several peak runoff rates might be considered for ultimate design recommendation. The magnitude of storm runoff was therefore calculated for 10, 25, 50 and 100 year frequencies. The hydrologic design data sheets for these frequencies are included in the Appendix.

## II. DRAINAGE AREA LIMITS

The size and length of drainage areas contributing to runoff were determined from recent aerial photos enlarged to a scale of 1" = 1000'. For purposes of the report these areas were transposed on Exhibit B at half scale.

Offsite ground elevations for determining slopes were obtained as previously mentioned from USGS quadrangles. These were checked where possible by reference to Arizona Highway and CAP contour maps. Onsite elevations were obtained from contour maps furnished by the Engineering Department of General Motors Desert Proving Ground.

The average width of the area was calculated by dividing the area in square feet by the length measured along the flow path of major washes. The width factor for adjusting the time of concentration is a function of average width and was chosen from the following table:

| Average Area Width | Width Factor |
|---|---|
| 0 - 600 | 1.24 |
| 600 - 1200 | 1.10 |
| 1200 - 2400 | 1.00 |
| Over 2400 | .89 |

## III. HYDROLOGIC SOIL - COVER COMPLEX

Of the major cover complexes encountered in Arizona, the herbaceous group best describes the vegetative cover of the study area. By aerial and onsite inspection its density was estimated to be 10%.

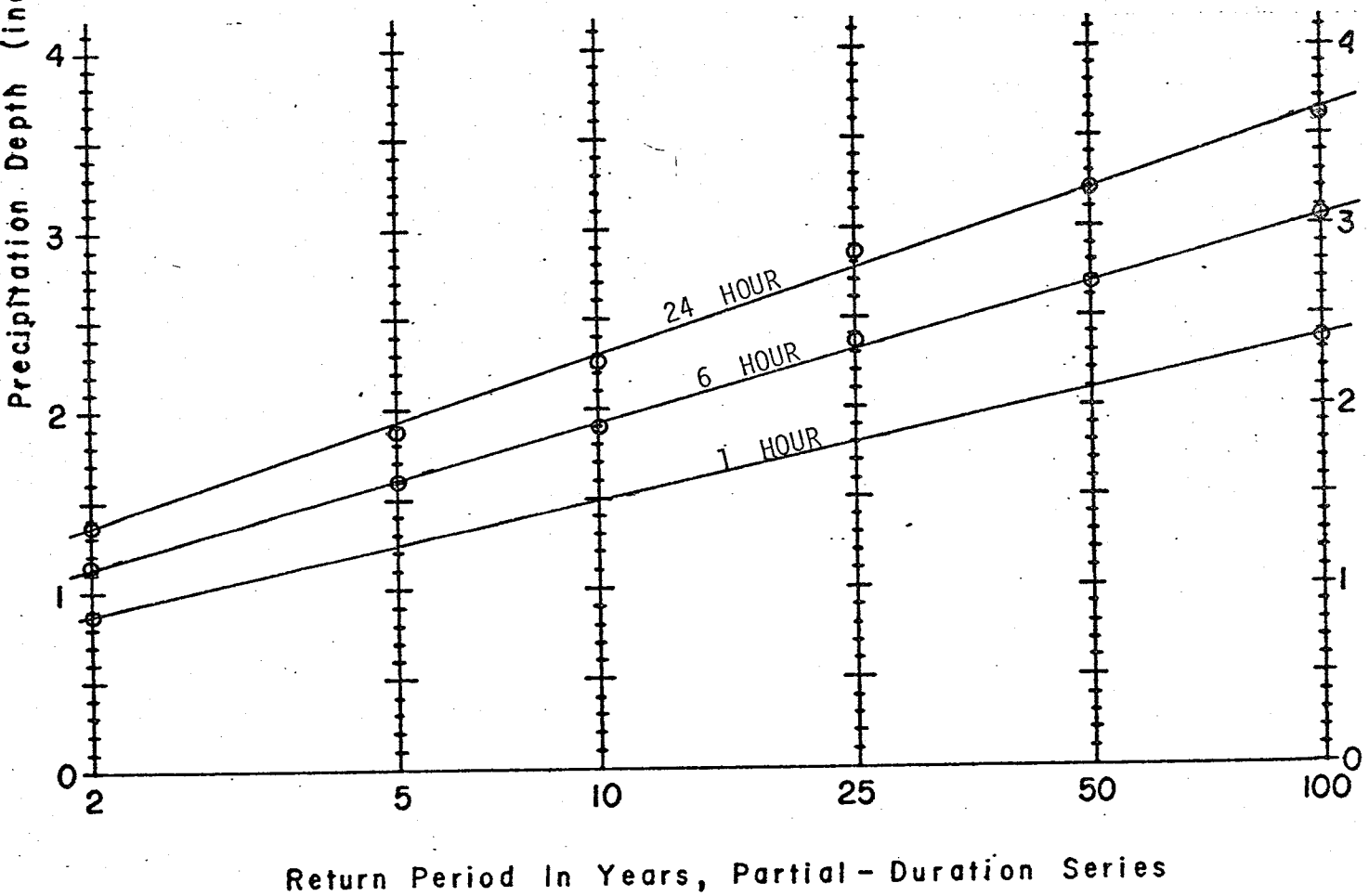
The Group B classification for the surface soil in the area was taken from the General Soil Maps of Maricopa and Pinal Counties prepared by the Soil Conservation Service.

## IV. PRECIPITATION

Rainfall amounts for storm durations of 6 and 24 hours and return periods of 2, 5, 10, 25, 50 and 100 years were obtained from precipitation maps included in the Appendix. These amounts shown in Table 1 were plotted on the precipitation versus return period graph (Figure 2). From a line of best fit corrected values were obtained. Using the 6 and 24 hour corrected values for the 2 and 100 year return periods,

| Return Period (Years) | Precipitation Values (inches) | | | |
|---|---|---|---|---|
| | 6 hour duration | | 24 hour duration | |
| | Map Value | Corrected Value | Map Value | Corrected Value |
| 2 | 1.12 | 1.12 | 1.35 | 1.35 |
| 5 | 1.60 | 1.61 | 1.88 | 1.91 |
| 10 | 1.90 | 1.92 | 2.26 | 2.30 |
| 25 | 2.36 | 2.41 | 2.88 | 2.78 |
| 50 | 2.68 | 2.69 | 3.20 | 3.20 |
| 100 | 3.04 | 3.04 | 3.60 | 3.72 |

TABLE 1




Precipitation Depth Versus Return Period for Partial – Duration Series

FIGURE 2

the 1 hour values were derived by use of the following equations and plotted on the graph.

$$2 \text{ year} = 0.011 + (0.942)\ \frac{(1.12^2)}{(1.35)} = 0.86$$

$$100 \text{ year} = 0.494 + (0.755)\ \frac{(3.04^2)}{(3.72)} = 2.37$$

Precipitation from 1-hour duration storms is considered to yield peak runoff rates for drainage areas less than 10 square miles.

## V. STORM RUNOFF

The relationship between rainfall and runoff is shown graphically in Figure 3 where direct runoff (Q) is a function of storm rainfall and a curve number (CN). The curve number obtained from Figure 4 is based on the vegetative cover type and density and the hydrologic soil group.

## VI. TIME OF CONCENTRATION

The time of concentration was estimated by use of the following equation:

$$T_c = \frac{L^{1.15}}{7700\ H^{0.38}}$$

$T_c$ = time of concentration - hours

L = length of drainage area - feet

H = elevation difference - feet

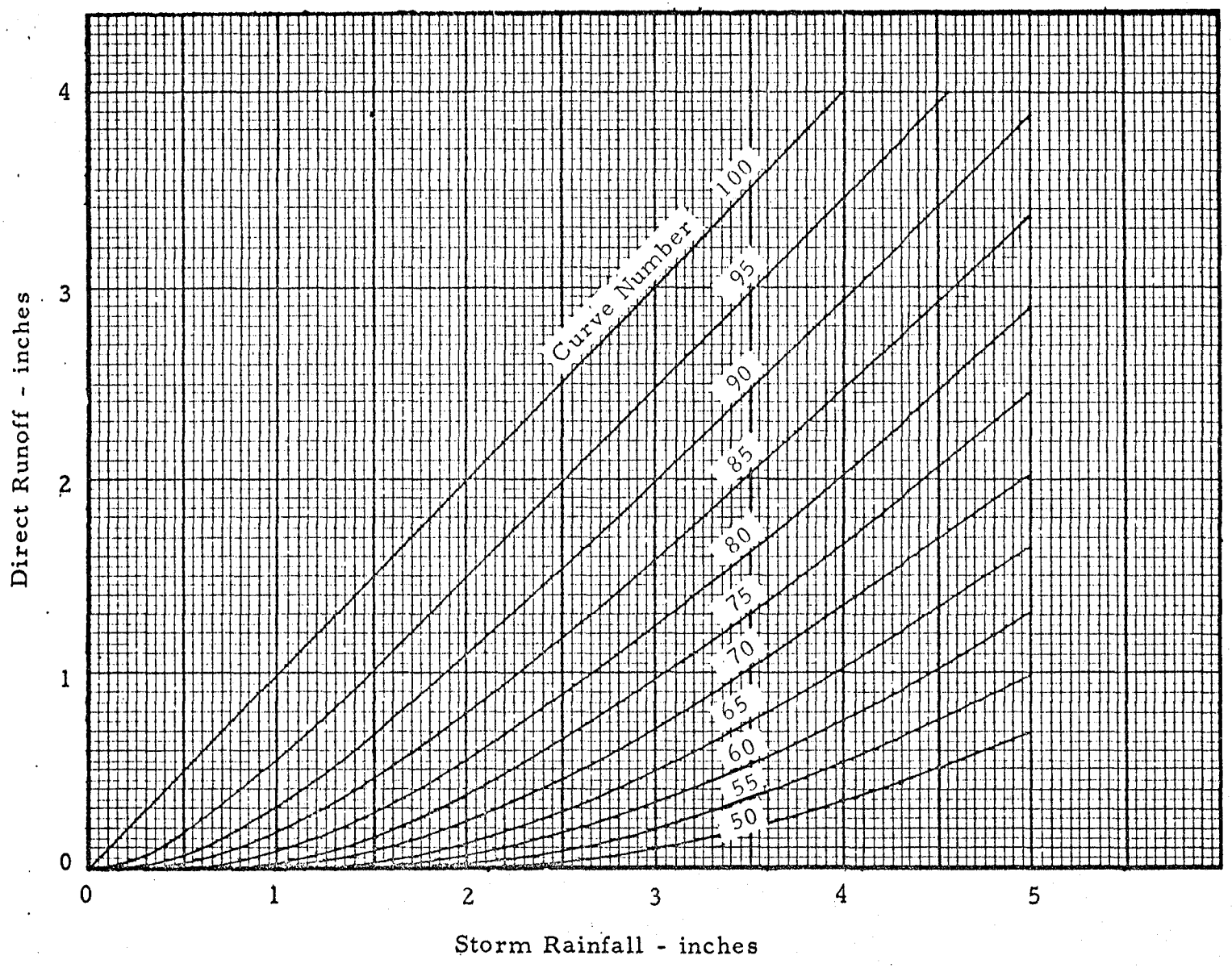



FIGURE 3

SOLUTION OF
RAINFALL - RUNOFF EQUATION

Soil Conservation Service

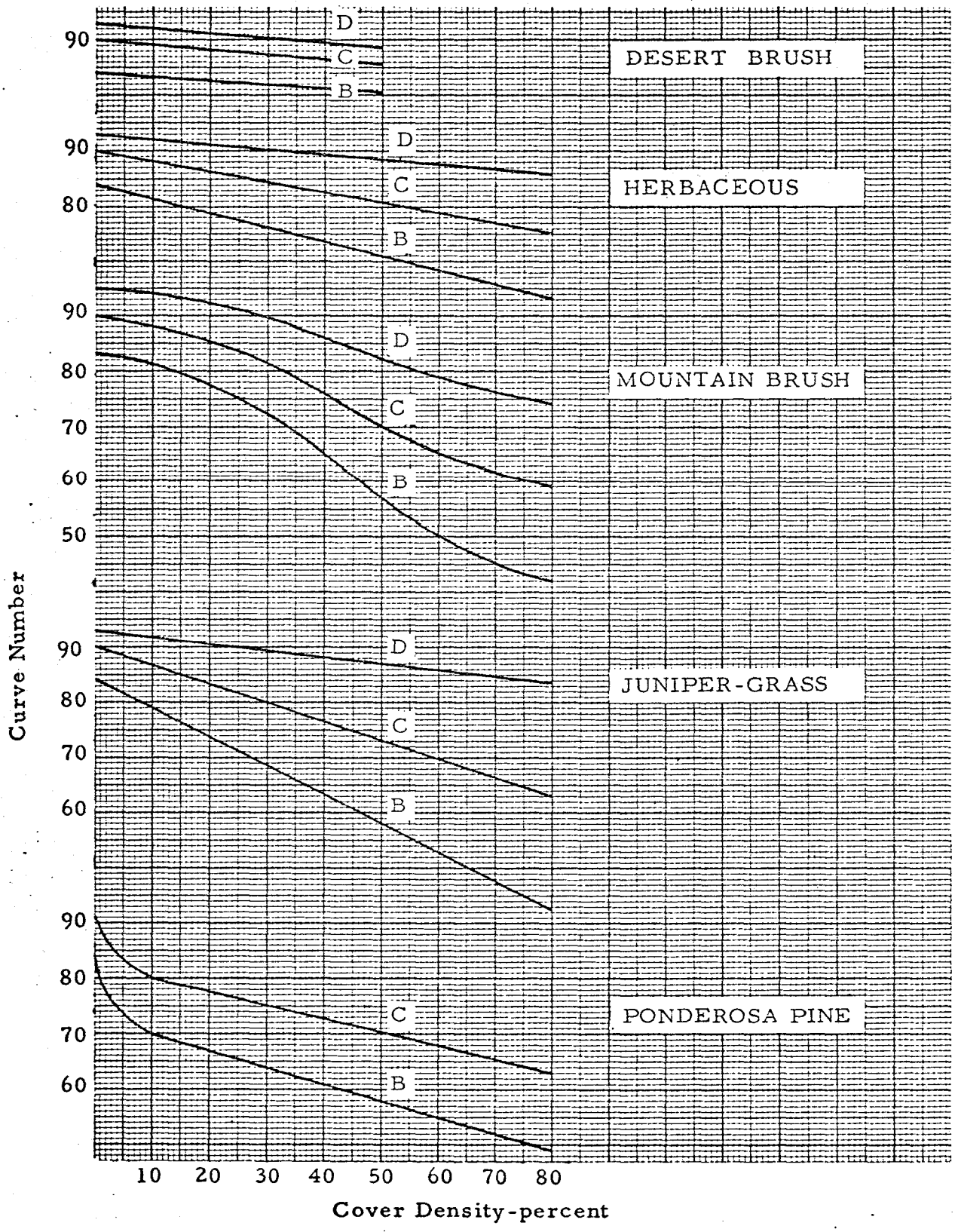



FIGURE 4

HYDROLOGIC SOIL - COVER COMPLEXES
AND ASSOCIATED CURVE NUMBERS

## VII. PEAK DISCHARGE

The peak runoff rate for each storm frequency of 1-hour duration and area characteristics was obtained by equation:

$$Q_p = \frac{484\ AQ}{T_p}$$

$Q_p$ = peak discharge rate - cubic feet per second

$A$ = drainage area - square miles

$Q$ = direct storm runoff - inches

$T_p$ = time of concentration - hours
(where $T_p = (T_c)$(width factor)

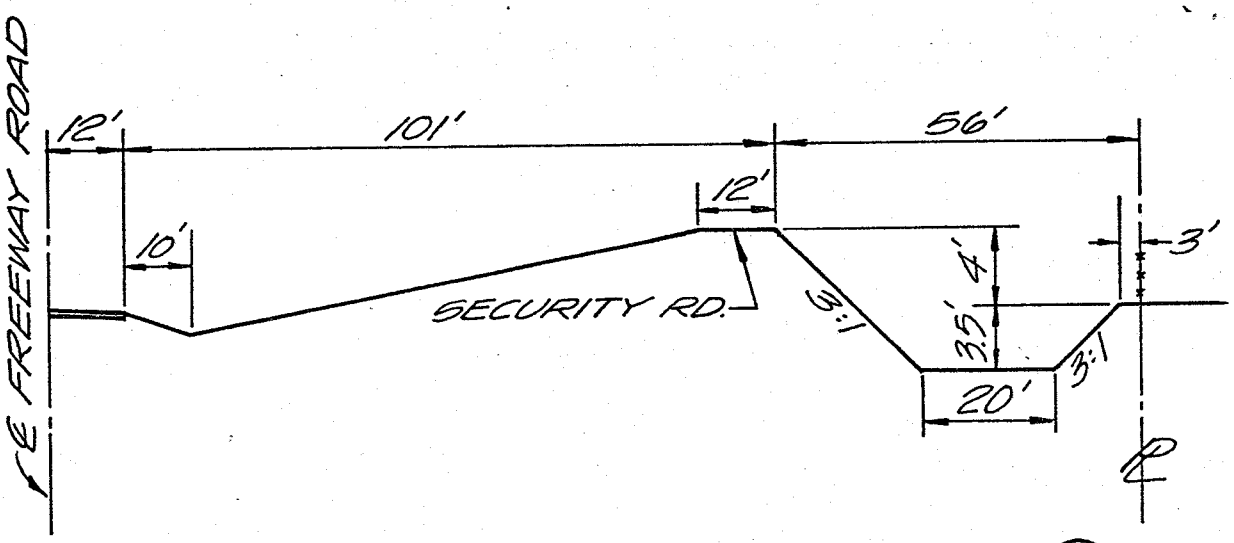
# SUMMARY

All of the offsite storm runoff entering along the north and northeasterly perimeter of the Proving Ground flows through the area of the new Ride and Structure Development Road. Determination of peak discharge and accumulated runoff for this area is therefore of prime importance. By observation, the 50 and 100 year frequency storms yield excessive runoff for this project. This summary, therefore, is limited to consideration of the 10 year and 25 year storms. Exhibit A shows onsite drainage areas, drainageways, points of runoff accumulation and rates in cubic feet per second for a 10 year storm. These rates and those for a 25 year storm are tabulated in Figure 7.

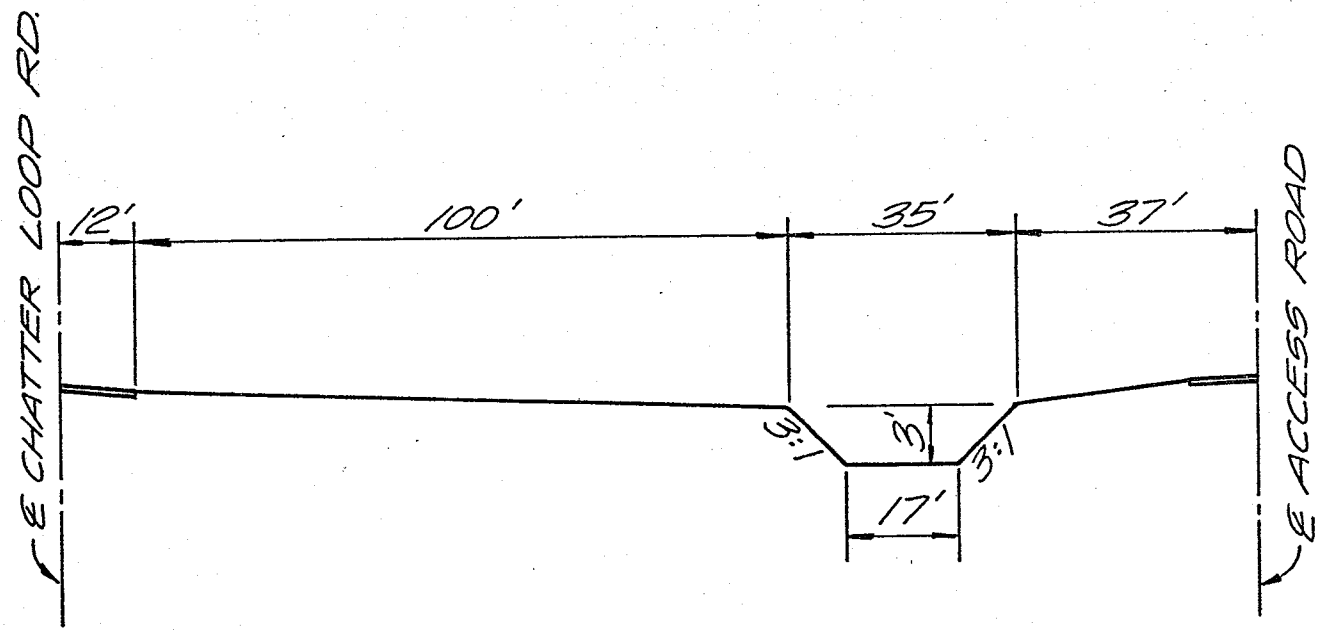
Drainageways A and B intercept and, where possible, divert runoff in the area to take advantage of existing flow patterns without extensive use of multiple pipe installation or box culverts.

Location of the Development Road in relation to the north boundary line of the Proving Ground limits the available space as shown in Figures 5 and 6 for sizing the channel to carry runoff from the storm frequencies being considered. This drainageway intercepts all of the runoff from Areas I, II and III which is approximately 70% of the total peak discharge.

A similar condition of limited space is also encountered where the chatter loop, access road and circle track converge. Sufficient width is not available between the access road and circle track for construction of Drainageway B.



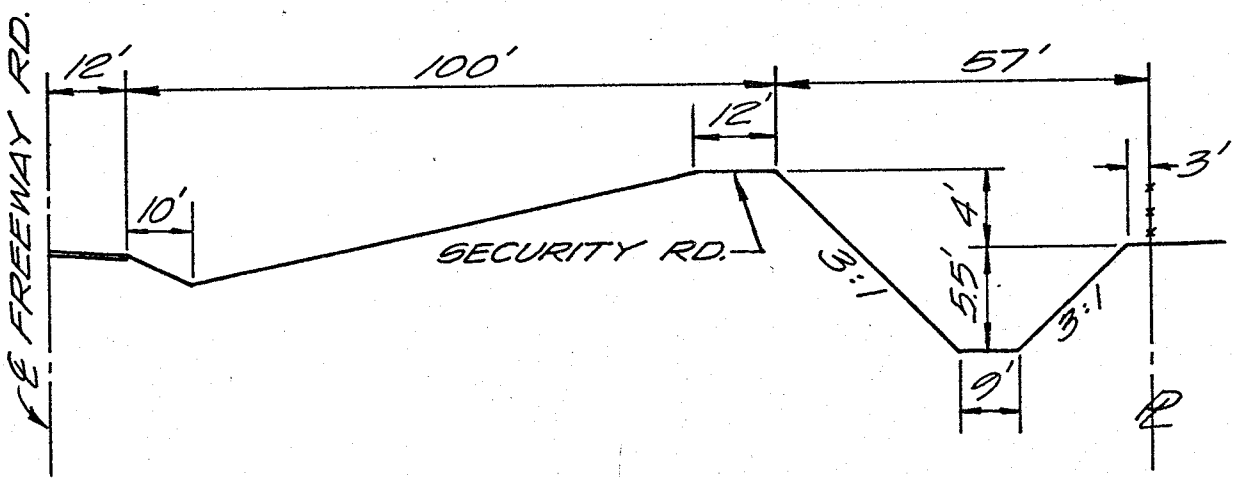

DRAINAGEWAY A AT (2)



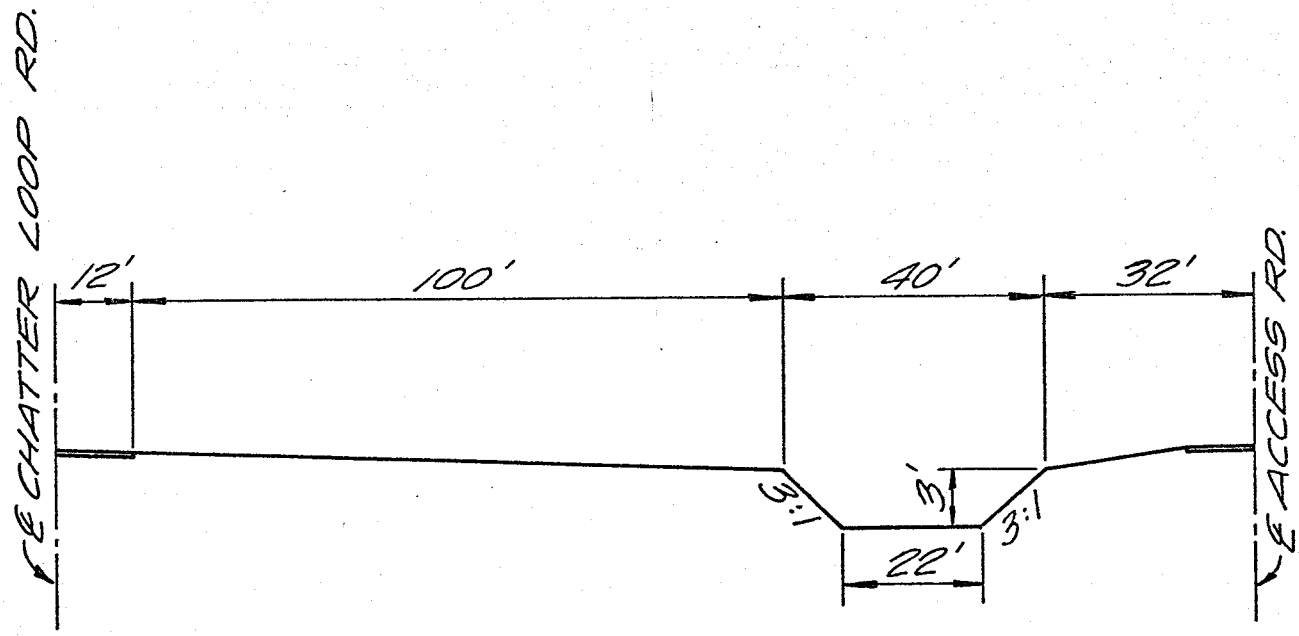

DRAINAGEWAY B AT (7)

# CHANNEL SECTIONS 10 YR. STORM

FIGURE 5




DRAINAGEWAY A AT (2)




DRAINAGEWAY B AT (7)

# CHANNEL SECTIONS
# 25 YR. STORM

FIGURE 6

## SUMMARY OF PEAK DISCHARGE

| Designation | Area (Ac) | Peak Discharge (cfs) 10 yr. | 25 yr. | 50 yr. |
|---|---|---|---|---|
| I | 232 | 52 | 67 | 92 |
| II | 1753 | 250 | 394 | 538 |
| III | 2100 | 299 | 472 | 644 |
| IV | 238 | 73 | 115 | 157 |
| V | 275 | 49 | 79 | 106 |
| VI | 1040 | 169 | 266 | 364 |

## SUMMARY OF ACCUMULATED RUNOFF

| Drainageway A | Accumulated Runoff (cfs) Design Storm = 10 yr. | 25 yr. |
|---|---|---|
| Point 1 | 551 | 869 |
| 2 | 582 | 918 |
| 3 | 595 | 937 |
| **Drainageway B** | | |
| Point 4 | 242 | 382 |
| 5 | 250 | 395 |
| 6 | 315 | 497 |
| 7 | 320 | 505 |
| 8 | 333 | 525 |
| **Drainageway C** | | |
| Point 9 | 17 | 27 |
| 10 | 23 | 36 |
| 11 | 107 | 169 |
| 12 | 111 | 175 |
| **Drainageway D** | | |
| Point 13 | 44 | 69 |
| 14 | 221 | 348 |
| 15 | 244 | 383 |
| 16 | 271 | 426 |
| 17 | 273 | 430 |

FIGURE 7

The alternate alignment of this drainageway in the area between the chatter loop and access road will require installation of multiple culverts or construction of dip sections at the two access road crossings. This location, however, allows for flexibility in channel sizing as shown on the channel sections. This drainageway is intended to intercept all of the runoff from Areas IV, V and VI.

Accumulated storm runoff affecting construction of the new access road west of the circle track will originate within the boundaries of the Proving Ground. Essentially this runoff will be the same as exists at the present time. From investigation of existing storm drain facilities it appears that a 10-year frequency storm might have been used before to determine runoff. For this report these areas have been calculated for both 10 and 25 year storms to provide additional data for later design consideration (Figure 7).

Runoff from areas $C_1$ and $C_2$ is unchanged except for diverting the outfall from $C_2$ into a small drainageway running southwest to be intercepted by the channel draining $C_1$.

Drainageway D is an existing system except for that portion at the easterly end which may require additional channelization to assure drainage to existing culverts under the circle track. This system terminates in the vicinity of the new access road in four distinct drainage channels where ponding presently occurs. Elevations at the upper end of these channels compared with the lowest elevation on Ellsworth Road for draining this area show a difference of 0.3' in 500'

or a slope of 0.06%. A design to provide control of excess flow will be necessary in this area.

No change is anticipated in the drainage of area E, except to improve flow characteristic in the vicinity of the new access road.

In conjunction with grading required for construction of drainage channels, dikes and other features for the protection of the Ride and Structure Development and Access Roads, a means of concealing new model cars from view by persons on the perimeter of the Proving Ground may be provided.

Along the north boundary where Drainageway A parallels the freeway portion of the Road, the inside bank forming a part of the channel can be extended to a height of at least four feet as shown on Figures 5 and 6. The top of this bank will then provide space for the security road.

A similar barrier between Ellsworth Road and the main and chatter loops of the Development Road would be an extension of above channel bank. This would serve the dual purpose of concealment and flood protection.

Those portions of the access road unprotected by existing brush may be screened by earth mounds of varying height.

Along channel banks and in other areas requiring additional screening, the use of native brush should prove adequate.

| AREAS (ACRES) | |
|---|---|
| A1 | 14 |
| A2 | 14 |
| A3 | 348 |
| A4 | 15 |
| B1 | 40 |
| B2 | 132 |
| B3 | 27 |
| B4 | 7 |
| B5 | 42 |
| B6 | 47 |
| C1 | 260 |
| C2 | 28 |
| C3 | 15 |
| C4 | 21 |
| C5 | 14 |
| D1 | 147 |
| D2 | 781 |
| D3 | 119 |
| D4 | 129 |
| D5 | 18 |
| D6 | 11 |
| E1 | 76 |

# ONSITE DRAINAGE AREAS

SCALE: 1" = 1000'

ELLIS, MURPHY & HOLGATE

CONSULTING CIVIL ENGINEERS

(8) Point designation

[69] Accumulated runoff (c.f.s.)

—·····— Proposed channel

····· Drainage area boundary

EXHIBIT A

ELLSWORTH ROAD
CRISMON ROAD
SIGNAL BUTTE RD.
MERIDIAN ROAD
IRONWOOD ROAD
POWER LINE FLOOD CONTROL DAM
IDAHO ROAD
TOMAHAWK DRIVE
MOUNTAIN VIEW ROAD
BROADWAY ROAD
SOUTHERN AVENUE
BASELINE ROAD
GUADALUPE ROAD
ELLIOT ROAD
WARNER ROAD
RAY ROAD
℄ PROPOSED SUPERSTITION FREEWAY
PROPOSED CAP AQUEDUCT
POWER LINE DAMS
VINEYARD DAM
℄ POWERLINE FLOODWAY
Design storm limits
AREA IIa 309 AC.
AREA I 232 AC.
AREA II 1753 AC.
AREA III 2100 AC.
AREA IV 238 AC.
AREA V 275 AC.
AREA VI 1040 AC.
SEE EXHIBIT A FOR ONSITE DRAINAGE AREAS
1500
1600
1650
1550
1450
1400
1700
80
89

N
W
E
S

# OFFSITE DRAINAGE AREAS

SCALE: 1" = 2,000' MARCH 1976

ELLIS, MURPHY & HOLGATE

CONSULTING CIVIL ENGINEERS

EXHIBIT B

# APPENDIX

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $A_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .02 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | | hours |
| Time of Peak | Tp | | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.02)(0.33)}{1.75}$ | |
| | | = | 2 | cfs |
| Discharge at Area II + III | | + | 549 | cfs |
| Total Discharge at 1 | | = | 551 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $A_2 + 1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.38 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.20 | hours |
| Time of Peak | Tp | | 1.95 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(0.38)(0.33)}{1.95}$ | |
| | | = | 31 | cfs |
| Discharge at 1 | | + | 551 | cfs |
| Total Discharge at 2 | | = | 582 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $A_3 + A_4$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.57 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.12 | hours |
| Time of Peak | Tp | | 2.07 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(0.57)(0.33)}{2.07}$ | |
| | | = | 44 | cfs |
| Discharge at 2 | | + | 551 | cfs |
| Total Discharge at 3 | | = | 595 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation V & VI

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 1.70* | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | | hours |
| Time of Peak | Tp | | 1.12 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(1.70)(0.33)}{1.12}$ | |
| | | = | | cfs |
| Discharge at _____ | | + | | cfs |
| Total Discharge at 4 | | = | 242 | cfs |

*Design storm limits = 1088 A.C.

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $B_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.06 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.08 | hours |
| Time of Peak | Tp | | 1.20 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(0.06)(0.33)}{1.20}$ | |
| | | = | 8 | cfs |
| Discharge at 4 | | + | 242 | cfs |
| Total Discharge at 5 | | = | 250 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation IV + $B_2$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.58 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.23 | hours |
| Time of Peak | Tp | | 1.43 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(0.58)(0.33)}{1.43}$ | |
| | | = | 65 | cfs |
| Discharge at 5 | | + | 250 | cfs |
| Total Discharge at 6 | | = | 315 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $B_3 + B_4$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .05 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.18 | hours |
| Time of Peak | Tp | | 1.61 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.05)(0.33)}{1.61}$ | |
| | | = | 5 | cfs |
| Discharge at 6 | | + | 315 | cfs |
| Total Discharge at 7 | | = | 320 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $B_5 + B_6$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .14 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.19 | hours |
| Time of Peak | Tp | | 1.80 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.14)(0.33)}{1.80}$ | |
| | | = | 13 | cfs |
| Discharge at 7 | | + | 320 | cfs |
| Total Discharge at 8 | | = | 333 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation $C_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.41 | square miles |
| Drainage Length | | 6,100 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1,428 | feet |
| At Structure (or Boundary) | | 1,396 | feet |
| Drainage Area Slope | | 0.52 | % |
| Drainage Width | | 1,857 | feet |
| Width factor $W_f$ | | 100 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 0.78 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.78 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.41)(.33)}{.78}$ | |
| | = | 84 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $C_2$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .03 * | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.29 | hours |
| Time of Peak | Tp | | 0.36 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.03)(.33)}{.36}$ | |
| | | = | 13 | cfs |
| Discharge at _____ | | + | | cfs |
| Total Discharge at _____ | | = | | cfs |

*Design storm limits = 20 ac.

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $C_2 + C_3$

DESIGN DATA:

| | | | | |
|---|---|---|---|---|
| Design Frequency | | | 10 | years |
| Drainage Area | A = | | .07 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | .33 | inches |
| Time in Channel | | | | hours |
| Time of Peak | Tp | | .65 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.07)(.33)}{.65}$ | |
| | | = | | cfs |
| Discharge at _____ | | + | | cfs |
| Total Discharge at 9 | | = | 17 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $C_4$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .03 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | .33 | inches |
| Time in Channel | | | .13 | hours |
| Time of Peak | Tp | | .78 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.03)(.33)}{.78}$ | |
| | | = | 6 | cfs |
| Discharge at 9 | | + | 17 | cfs |
| Total Discharge at 10 | | = | 23 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $C_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.41 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | 0.78 | hours |
| Time of Peak | Tp | | 0.78 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.41)(.33)}{.78}$ | |
| | | = | 84 | cfs |
| Discharge at 10 | | + | 23 | cfs |
| Total Discharge at 11 | | = | 107 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $C_5$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .02 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | .33 | | inches |
| Time in Channel | | .03 | | hours |
| Time of Peak | Tp | .81 | | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | $\frac{484(.02)(.33)}{.81}$ | | |
| | | 4 | | cfs |
| Discharge at 11 | | + 107 | | cfs |
| Total Discharge at 12 | | = 111 | | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area $D_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.23 | square miles |
| Drainage Length | | 4,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1,450 | feet |
| At Structure (or Boundary) | | 1,440 | feet |
| Drainage Area Slope | | 0.23 | % |
| Drainage Width | | 1,455 | feet |
| Width factor $W_f$ | | 1.00 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 0.84 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.84 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.23)(.33)}{.84}$ | |
| | @13 = | 44 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $D_2$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 1.22 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | .26 | hours |
| Time of Peak | Tp | | 1.10 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(1.22)(.33)}{1.10}$ | |
| | | = | 177 | cfs |
| Discharge at 13 | | + | 44 | cfs |
| Total Discharge at 14 | | = | 221 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $D_3$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .19 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | .33 | inches |
| Time in Channel | | | .25 | hours |
| Time of Peak | Tp | | 1.35 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.19)(.33)}{1.35}$ | |
| | | = | .23 | cfs |
| Discharge at 14 | | + | 221 | cfs |
| Total Discharge at 15 | | = | 244 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $D_4 + D_5$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.23 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | .33 | inches |
| Time in Channel | | | .01 | hours |
| Time of Peak | Tp | | 1.36 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.23)(.33)}{1.36}$ | |
| | | = | 27 | cfs |
| Discharge at 15 | | + | 244 | cfs |
| Total Discharge at 16 | | = | 271 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

ACCUMULATIVE RUNOFF

DRAINAGE AREA:

Designation $D_6$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | .02 | square miles |

DESIGN COMPUTATION:

| | | | | |
|---|---|---|---|---|
| Runoff | Q = | | 0.33 | inches |
| Time in Channel | | | .01 | hours |
| Time of Peak | Tp | | 1.37 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ | = | $\frac{484(.02)(.33)}{1.37}$ | |
| | | = | 2 | cfs |
| Discharge at 16 | | + | 271 | cfs |
| Total Discharge at 17 | | = | 273 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation $E_1$

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.08* | square miles |
| Drainage Length | | 2,300 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1,404 | feet |
| At Structure (or Boundary) | | 1,396 | feet |
| Drainage Area Slope | | 0.35 | % |
| Drainage Width | | 947 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 0.43 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.47 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(0.08)(0.33)}{0.47}$ | |
| | @ 18 = | 27 | cfs |

*Design Area = 50 Acres

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area I

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.36 | square miles |
| Drainage Length | | 11,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1491 | feet |
| At Structure (or Boundary) | | 1420 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 864 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 1.23 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.10 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.36)(.33)}{1.10}$ | |
| | = | 52 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area I

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 0.36 | square miles |
| Drainage Length | | 11,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1491 | feet |
| At Structure (or Boundary) | | 1420 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 864 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10% | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 1.23 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.35 | hours |

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(0.36)(.52)}{1.35}$

$= 67$ cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area I

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 0.36 | square miles |
| Drainage Length | | 11,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1491 | feet |
| At Structure (or Boundary) | | 1420 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 864 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 1.23 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.35 | hours |

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.36)(0.71)}{1.35}$

$= 92$ cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area I

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 0.36 | square miles |
| Drainage Length | | 11,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1491 | feet |
| At Structure (or Boundary) | | 1420 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 864 | feet |
| Width factor Wf | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 1.23 | hours |
| Time of Peak | Tp = (Tc)(Wf) | 1.35 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.36)(0.90)}{1.35}$ | |
| | = | 116 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area II

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 2.74 | square miles |
| Drainage Length | | 25,500 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1644 | feet |
| At Structure (or Boundary) | | 1430 | feet |
| Drainage Area Slope | | 0.84 | % |
| Drainage Width | | 2994 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(2.74)(.33)}{1.75}$ | |
| | = | 250 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area II

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 2.74 | square miles |
| Drainage Length | | 25,500 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1644 | feet |
| At Structure (or Boundary) | | 1430 | feet |
| Drainage Area Slope | | 0.84 | % |
| Drainage Width | | 2994 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | .82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(2.74)(.52)}{1.75}$ | |
| | = | 394 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area II

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 2.74 | square miles |
| Drainage Length | | 25,500 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1644 | feet |
| At Structure (or Boundary) | | 1430 | feet |
| Drainage Area Slope | | 0.84 | % |
| Drainage Width | | 2994 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} = \frac{484(2.74)(.71)}{1.75}$ | | |
| | = | 538 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area II

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 2.74 | square miles |
| Drainage Length | | 25,500 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1644 | feet |
| At Structure (or Boundary) | | 1430 | feet |
| Drainage Area Slope | | 0.84 | % |
| Drainage Width | | 2944 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(2.74)(.90)}{1.75}$ | |
| | = | 682 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area III

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 3.28 | square miles |
| Drainage Length | | 20,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1550 | feet |
| At Structure (or Boundary) | | 1435 | feet |
| Drainage Area Slope | | 0.56 | % |
| Drainage Width | | 4417 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(3.28)(.33)}{1.75}$ | |
| | = | 299 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area III

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 3.28 | square miles |
| Drainage Length | | 20,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1550 | feet |
| At Structure (or Boundary) | | 1435 | feet |
| Drainage Area Slope | | 0.56 | % |
| Drainage Width | | 4417 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(3.28)(.52)}{1.75}$ | |
| | = | 472 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area III

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 3.28 | square miles |
| Drainage Length | | 20,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1550 | feet |
| At Structure (or Boundary) | | 1435 | feet |
| Drainage Area Slope | | 0.56 | % |
| Drainage Width | | 4417 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(3.28)(.71)}{1.75}$ | |
| | = | 644 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area III

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 3.28 | square miles |
| Drainage Length | | 20,700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1550 | feet |
| At Structure (or Boundary) | | 1435 | feet |
| Drainage Area Slope | | 0.56 | % |
| Drainage Width | | 4417 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 1.97 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.75 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(3.28)(.90)}{1.75}$ | |
| | = | 816 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area IV

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.37 | square miles |
| Drainage Length | | 6700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1502 | feet |
| At Structure (or Boundary) | | 1463 | feet |
| Drainage Area Slope | | 0.58 | % |
| Drainage Width | | 1547 | feet |
| Width factor $W_f$ | | 1.00 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 0.81 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.81 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp}$ = | $\frac{484(.37)(.33)}{.81}$ | |
| | = | 73 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area IV

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 0.37 | square miles |
| Drainage Length | | 6700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1502 | feet |
| At Structure (or Boundary) | | 1463 | feet |
| Drainage Area Slope | | 0.58 | % |
| Drainage Width | | 1547 | feet |
| Width factor $W_f$ | | 1.00 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 0.81 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.81 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.37)(.52)}{0.81}$ | |
| | = | 115 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area IV

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 0.37 | square miles |
| Drainage Length | | 6700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1502 | feet |
| At Structure (or Boundary) | | 1463 | feet |
| Drainage Area Slope | | 0.58 | % |
| Drainage Width | | 1547 | feet |
| Width factor $W_f$ | | 1.00 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 0.81 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.81 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.37)(0.71)}{0.81}$ | |
| | = | 157 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area IV

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 0.37 | square miles |
| Drainage Length | | 6700 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1502 | feet |
| At Structure (or Boundary) | | 1463 | feet |
| Drainage Area Slope | | 0.58 | % |
| Drainage Width | | 1547 | feet |
| Width factor $W_f$ | | 1.00 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 0.81 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 0.81 | hours |

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(.37)(.90)}{0.81}$

$= 199$ cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area V

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 0.43 | square miles |
| Drainage Length | | 12,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1535 | feet |
| At Structure (or Boundary) | | 1456 | feet |
| Drainage Area Slope | | 0.64 | % |
| Drainage Width | | 966 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 1.26 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.39 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.43)(.33)}{1.39}$ | |
| | = | 49 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area V

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 0.43 | square miles |
| Drainage Length | | 12,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1535 | feet |
| At Structure (or Boundary) | | 1456 | feet |
| Drainage Area Slope | | 0.64 | % |
| Drainage Width | | 966 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 1.26 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.39 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.43)(.52)}{1.39}$ | |
| | = | 79 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area V

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 0.43 | square miles |
| Drainage Length | | 12,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1535 | feet |
| At Structure (or Boundary) | | 1456 | feet |
| Drainage Area Slope | | 0.64 | % |
| Drainage Width | | 966 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 1.26 | hours |
| Time of Peak | $T_p = (Tc)(W_f)$ | 1.39 | hours |
| Peak Discharge | $Q_p = \frac{484\ AQ}{Tp} = \frac{484(.43)(.71)}{1.39}$ | | |
| | = | 106 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area V

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 0.43 | square miles |
| Drainage Length | | 12,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1535 | feet |
| At Structure (or Boundary) | | 1456 | feet |
| Drainage Area Slope | | 0.64 | % |
| Drainage Width | | 966 | feet |
| Width factor $W_f$ | | 1.10 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 1.26 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.39 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(.43)(.90)}{1.39}$ | |
| | = | 134 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VI

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 10 | years |
| Drainage Area | A = | 1.63 | square miles |
| Drainage Length | | 18,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1565 | feet |
| At Structure (or Boundary) | | 1452 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 2474 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 1.92 | inches |
| P = 24 hour = | | 2.30 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.48 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.33 | inches |
| Time of Concentration | Tc | 1.73 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.54 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(1.63)(.33)}{1.54}$ | |
| | = | 169 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VI

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 25 | years |
| Drainage Area | A = | 1.63 | square miles |
| Drainage Length | | 18,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1565 | feet |
| At Structure (or Boundary) | | 1452 | feet |
| Drainage Area Slope | | 0.61 | % |
| Drainage Width | | 2474 | feet |
| Width factor $W_f$ | | 0.89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.41 | inches |
| P = 24 hour = | | 2.78 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 1.80 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.52 | inches |
| Time of Concentration | Tc | 1.73 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.54 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} = \frac{484(1.63)(.52)}{1.54}$ | | |
| | = | 266 | cfs |

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

Designation Area VI

DESIGN DATA:

| | | | |
|---|---|---|---|
| Design Frequency | | 50 | years |
| Drainage Area | A = | 1.63 | square miles |
| Drainage Length | | 18,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1565 | feet |
| At Structure (or Boundary) | | 1452 | feet |
| Drainage Area Slope | | .61 | % |
| Drainage Width | | 2474 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 2.69 | inches |
| P = 24 hour = | | 3.20 | inches |

DESIGN COMPUTATION:

| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.10 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.71 | inches |
| Time of Concentration | Tc | 1.73 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.54 | hours |

Peak Discharge $Qp = \frac{484\ AQ}{Tp} = \frac{484(1.63)(0.71)}{1.54}$

$= 364$ cfs

GENERAL MOTORS

DESERT PROVING GROUND

RIDE & STRUCTURE DEVELOPMENT ROAD

HYDROLOGIC DESIGN DATA SHEET

S C S METHOD: PART I

DRAINAGE AREA:

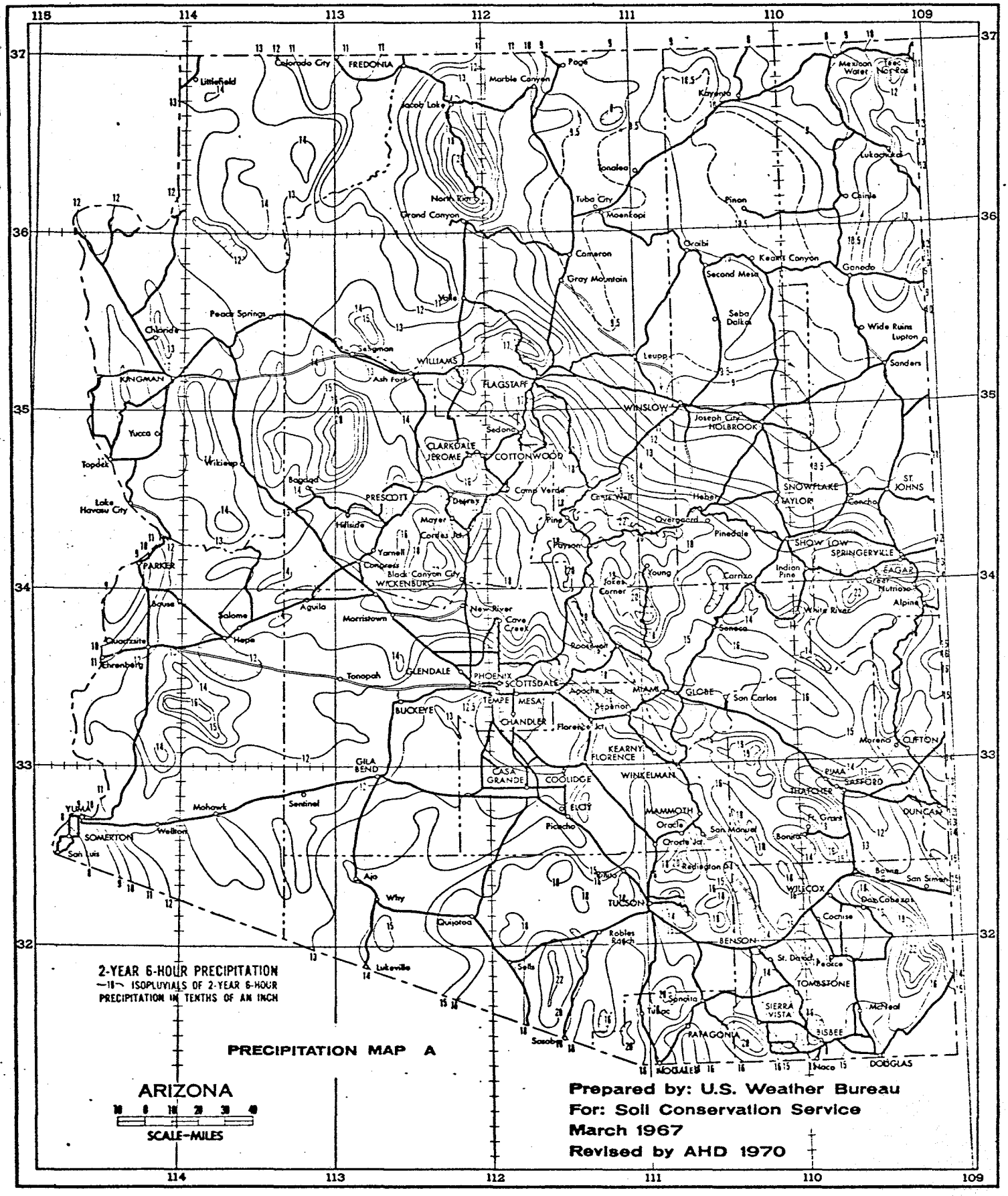
Designation Area VI

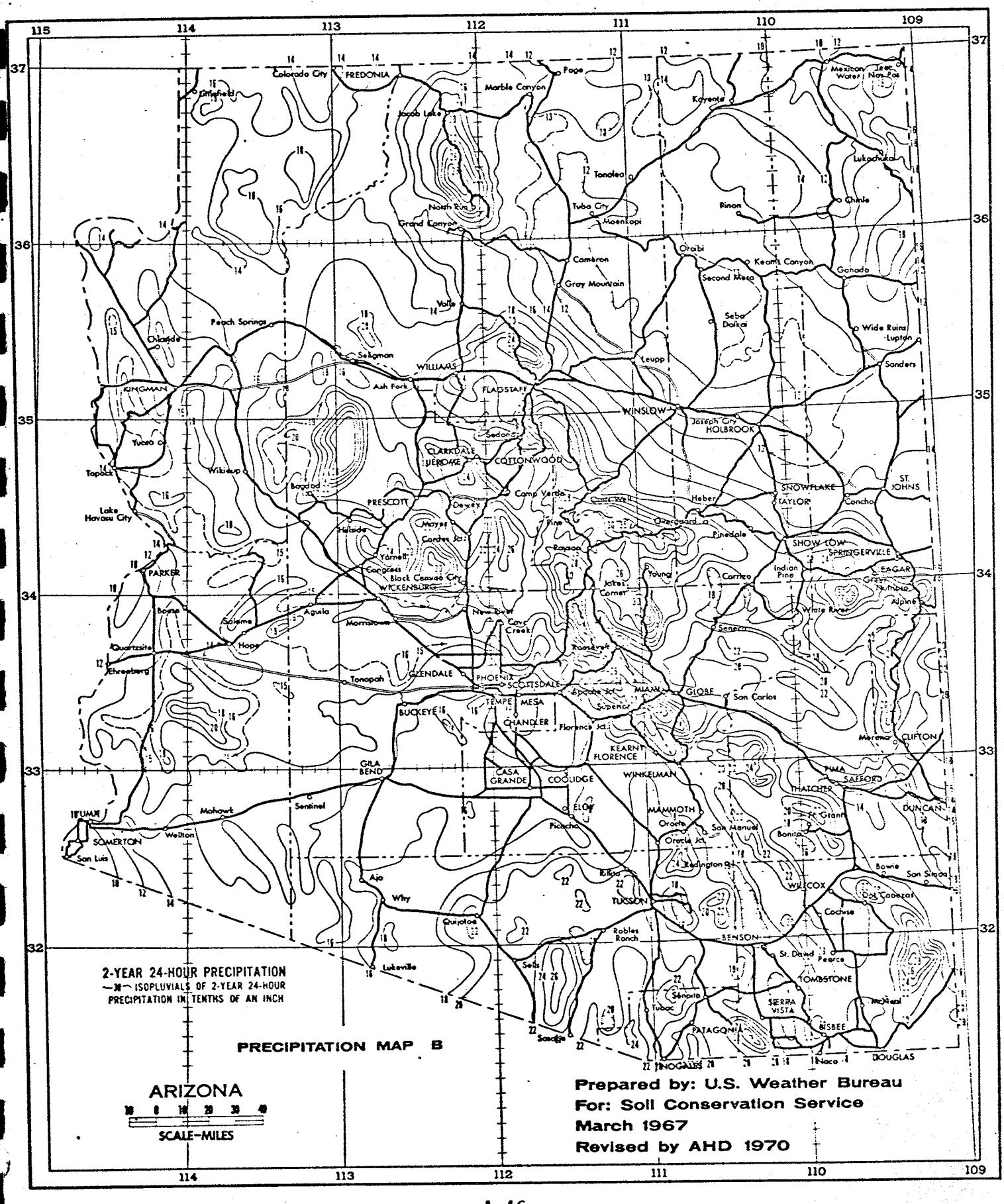
DESIGN DATA:

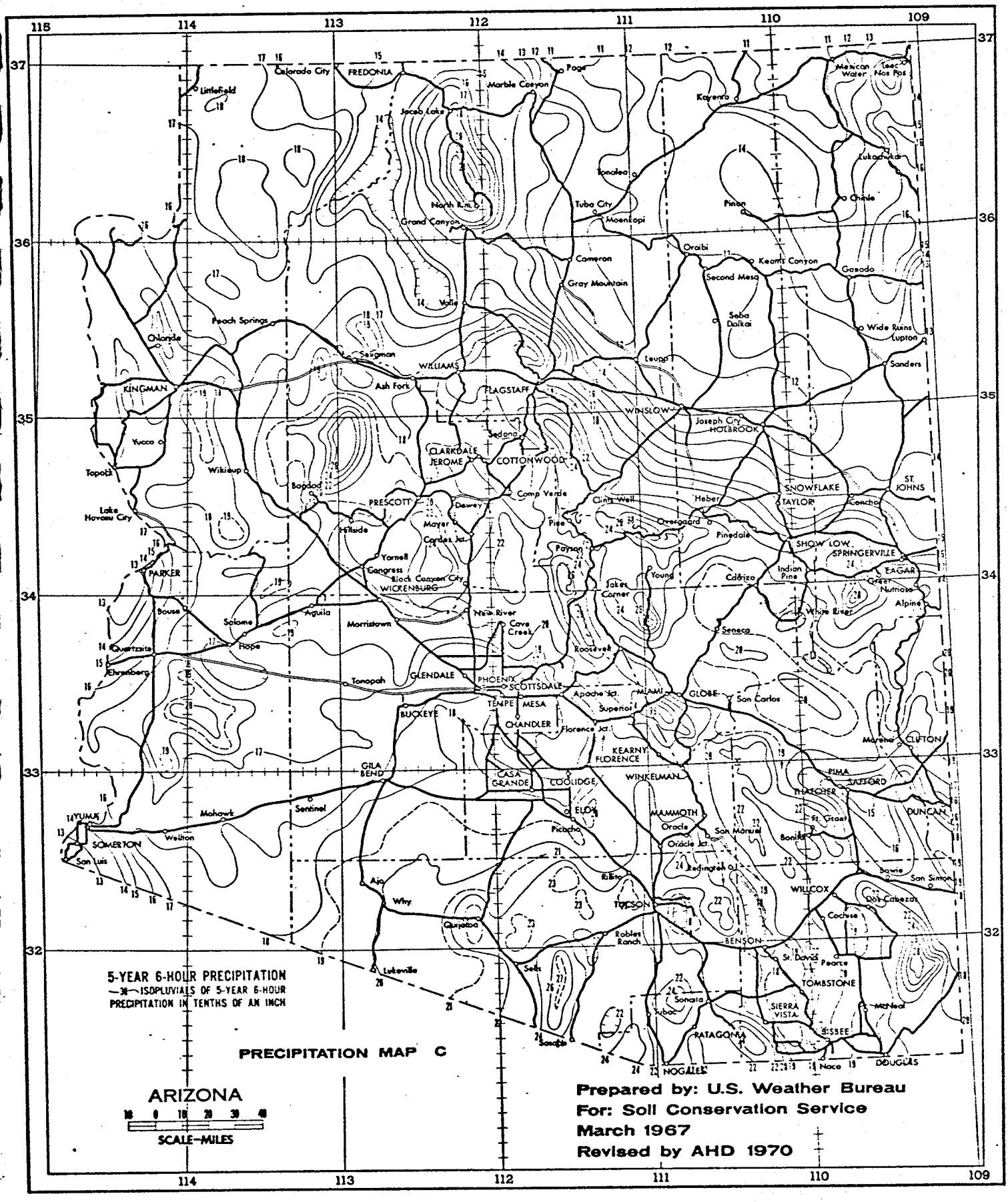
| | | | |
|---|---|---|---|
| Design Frequency | | 100 | years |
| Drainage Area | A = | 1.63 | square miles |
| Drainage Length | | 18,400 | feet |
| Elevation | | | |
| Top of Drainage Area | | 1565 | feet |
| At Structure (or Boundary) | | 1452 | feet |
| Drainage Area Slope | | .61 | % |
| Drainage Width | | 2474 | feet |
| Width factor $W_f$ | | .89 | |
| Vegetative Cover Type | | Herbaceous | |
| Vegetative Cover Density | | 10 | % |
| Soil Group | | B | |
| Precipitation | | | |
| P = 6 hour = | | 3.04 | inches |
| P = 24 hour = | | 3.72 | inches |

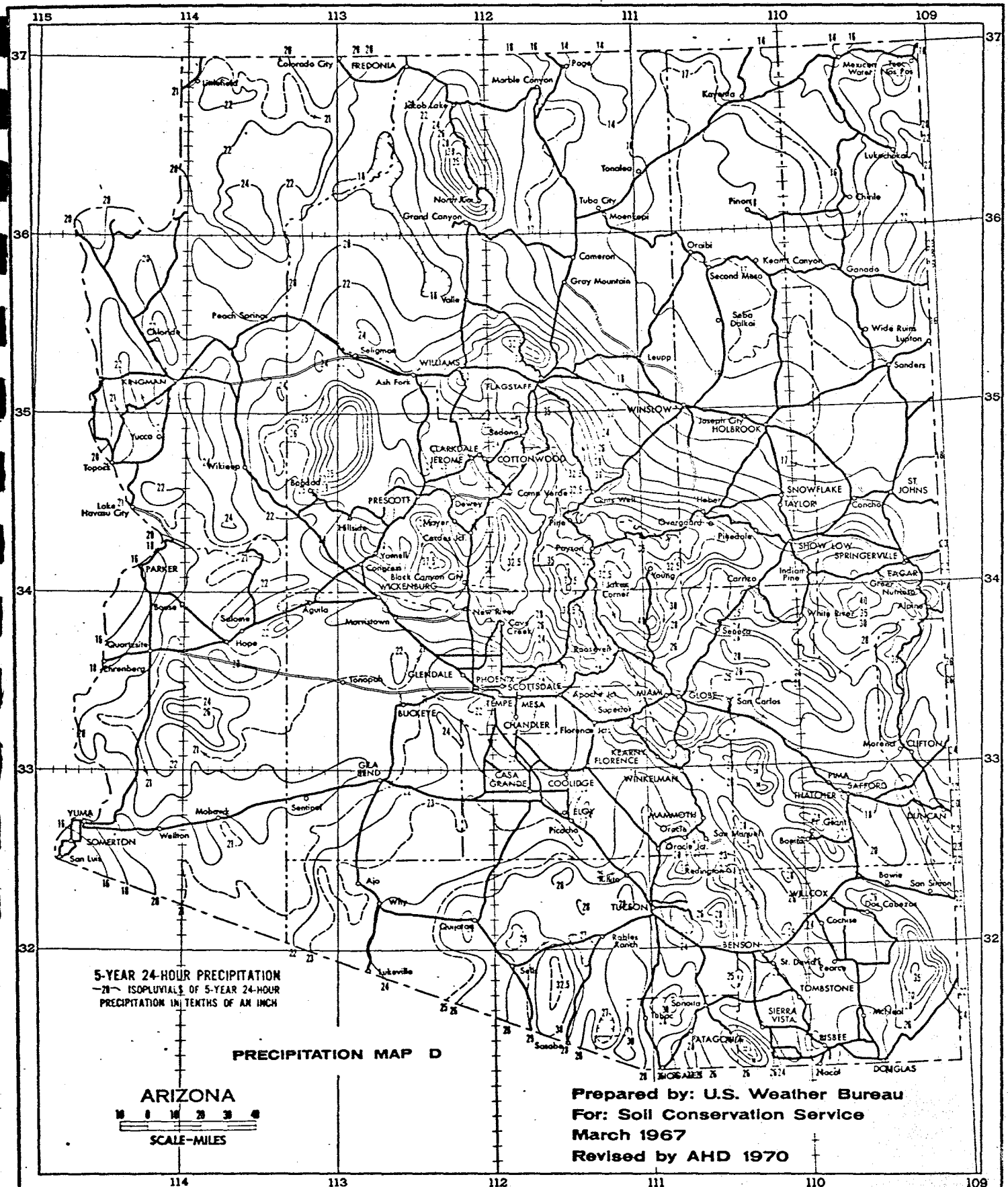
DESIGN COMPUTATION:

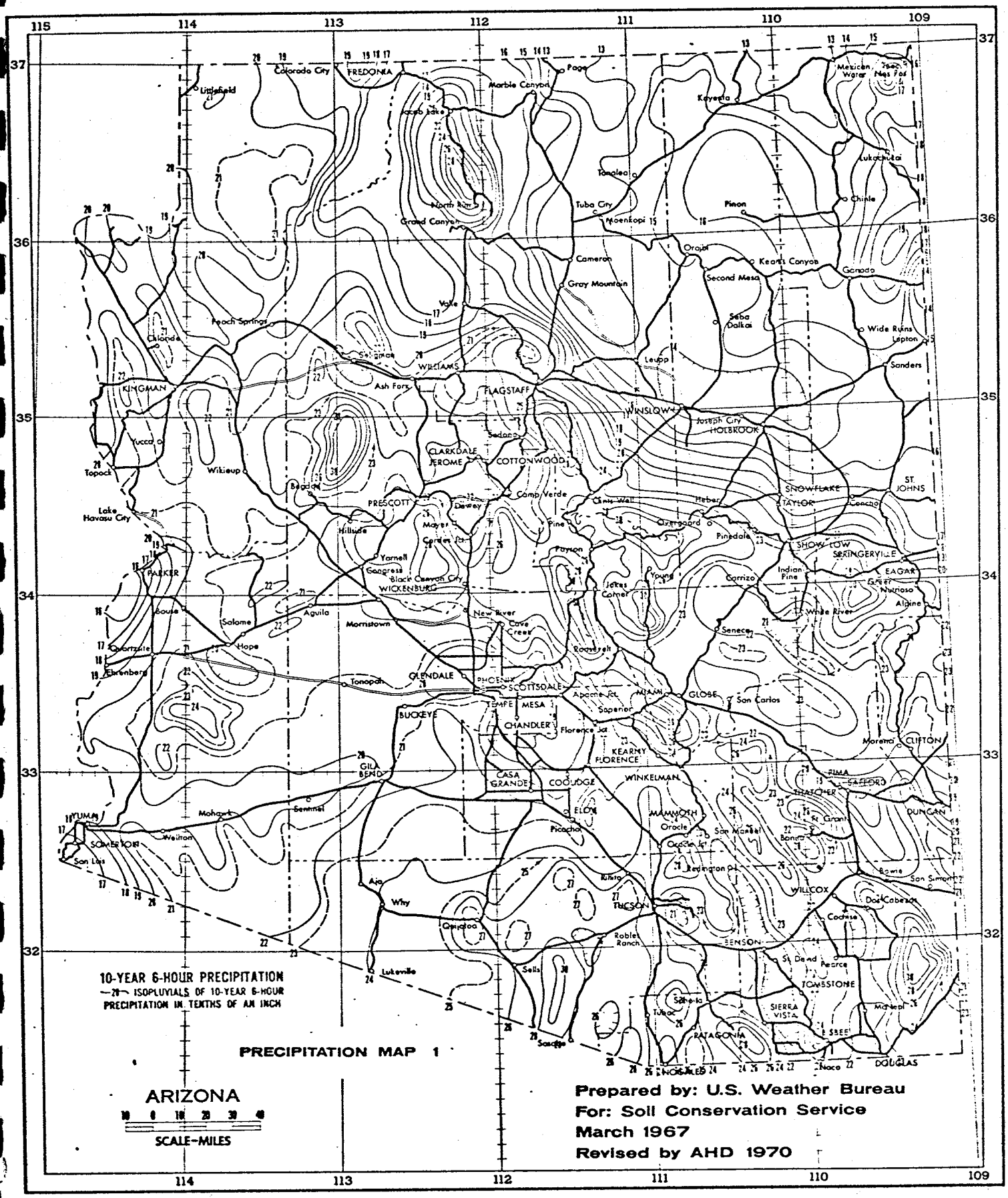
| | | | |
|---|---|---|---|
| Precipitation | P = 1 hour = | 2.37 | inches |
| Curve Number | | 82 | |
| Runoff | Q = | 0.90 | inches |
| Time of Concentration | Tc | 1.73 | hours |
| Time of Peak | $Tp = (Tc)(W_f)$ | 1.54 | hours |
| Peak Discharge | $Qp = \frac{484\ AQ}{Tp} =$ | $\frac{484(1.63)(.90)}{1.54}$ | |
| | = | 461 | cfs |

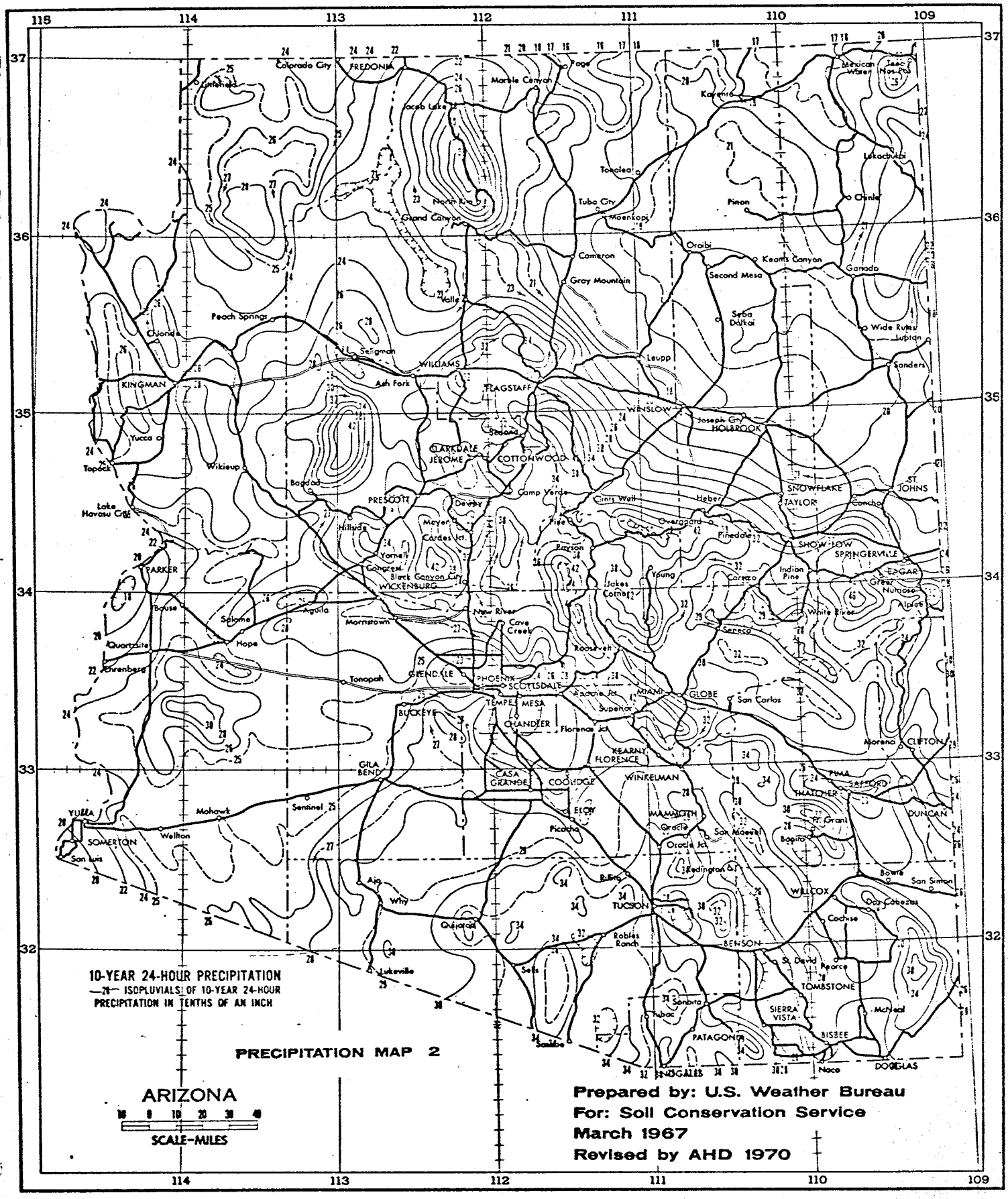

2-YEAR 6-HOUR PRECIPITATION
—18— ISOPLUVIALS OF 2-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP A
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

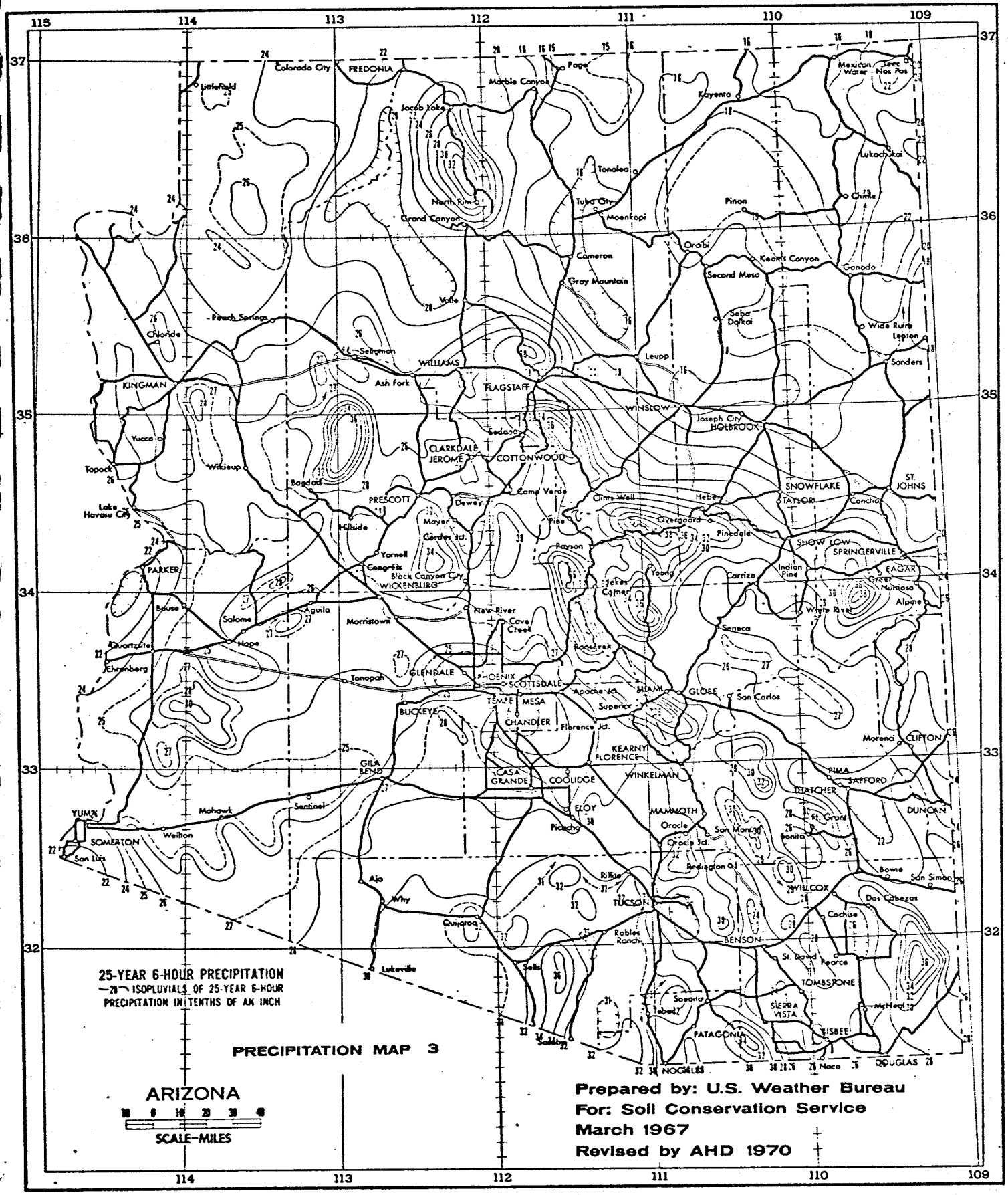

2-YEAR 24-HOUR PRECIPITATION
—30— ISOPLUVIALS OF 2-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP B
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

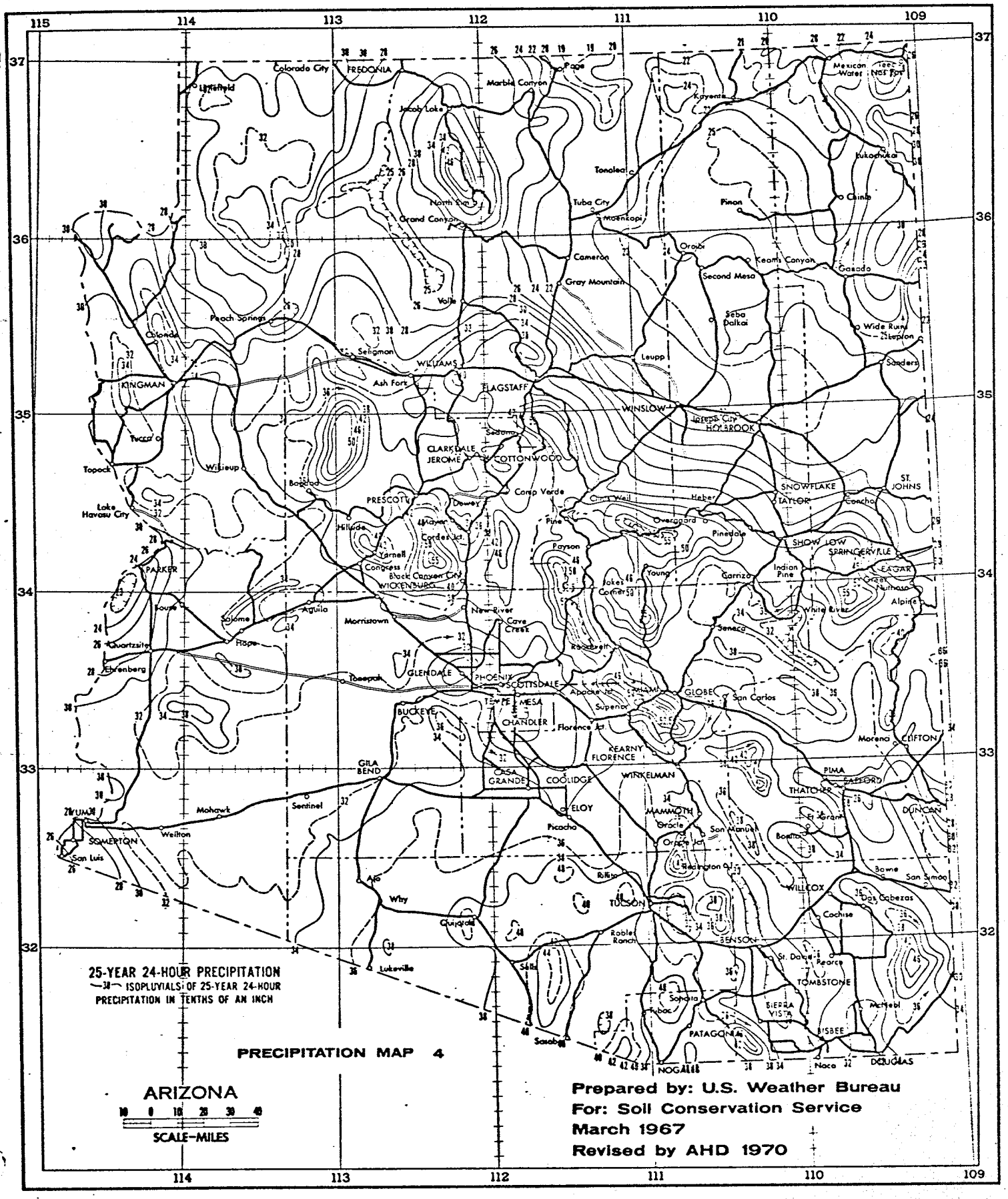

5-YEAR 6-HOUR PRECIPITATION
—36— ISOPLUVIALS OF 5-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP C
ARIZONA
SCALE—MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

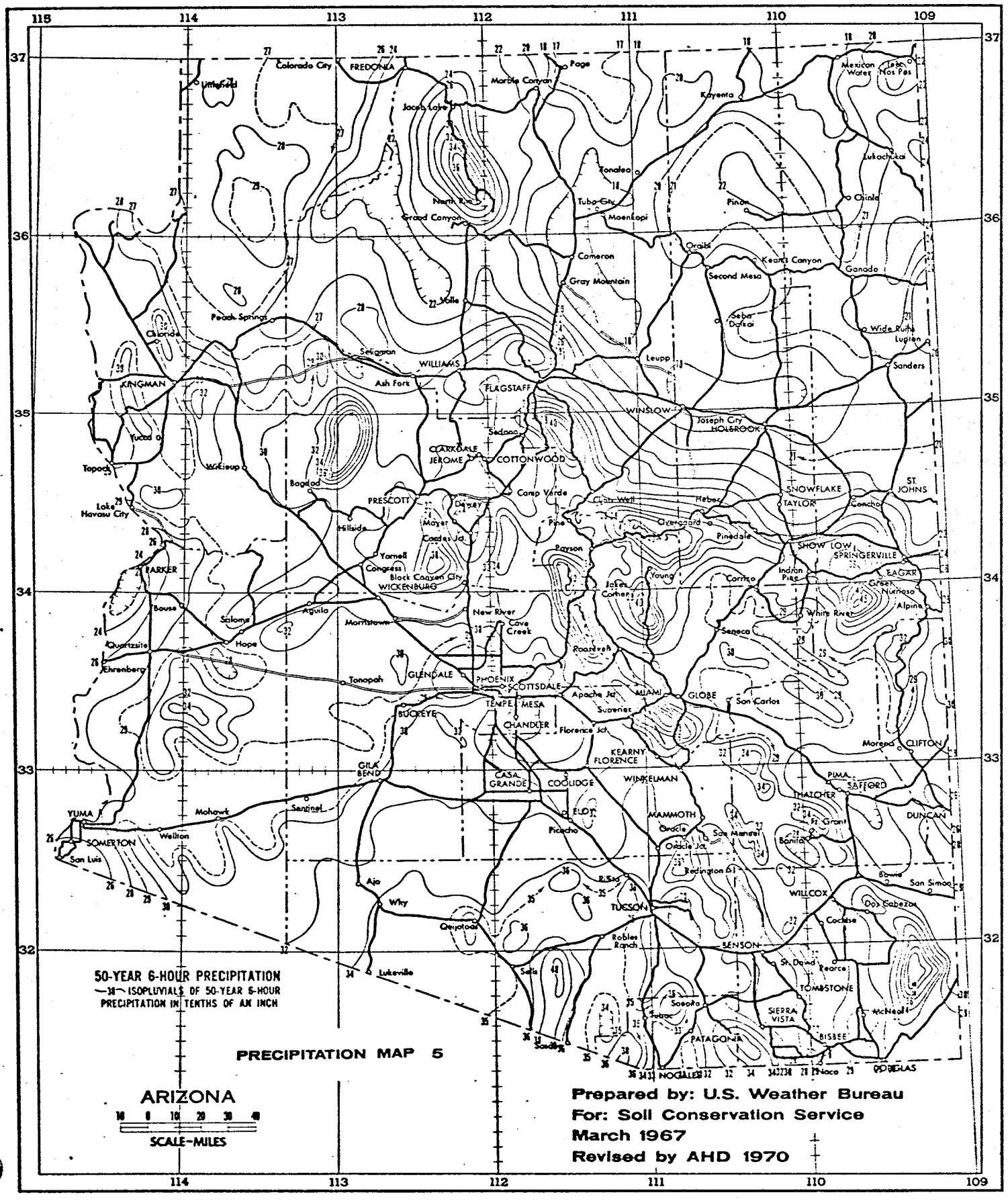

5-YEAR 24-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 5-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP D
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

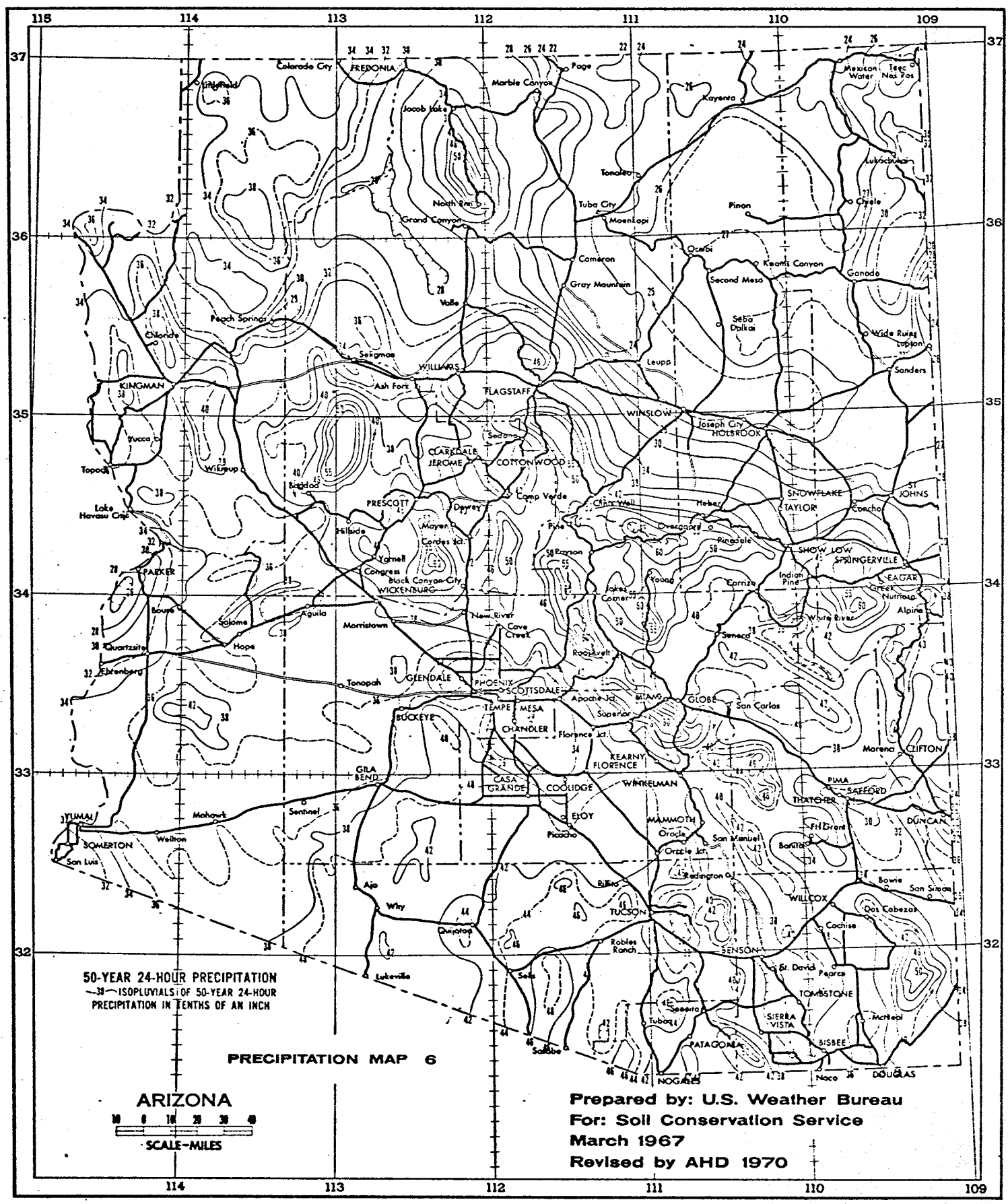

10-YEAR 6-HOUR PRECIPITATION
—20— ISOPLUVIALS OF 10-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 1
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

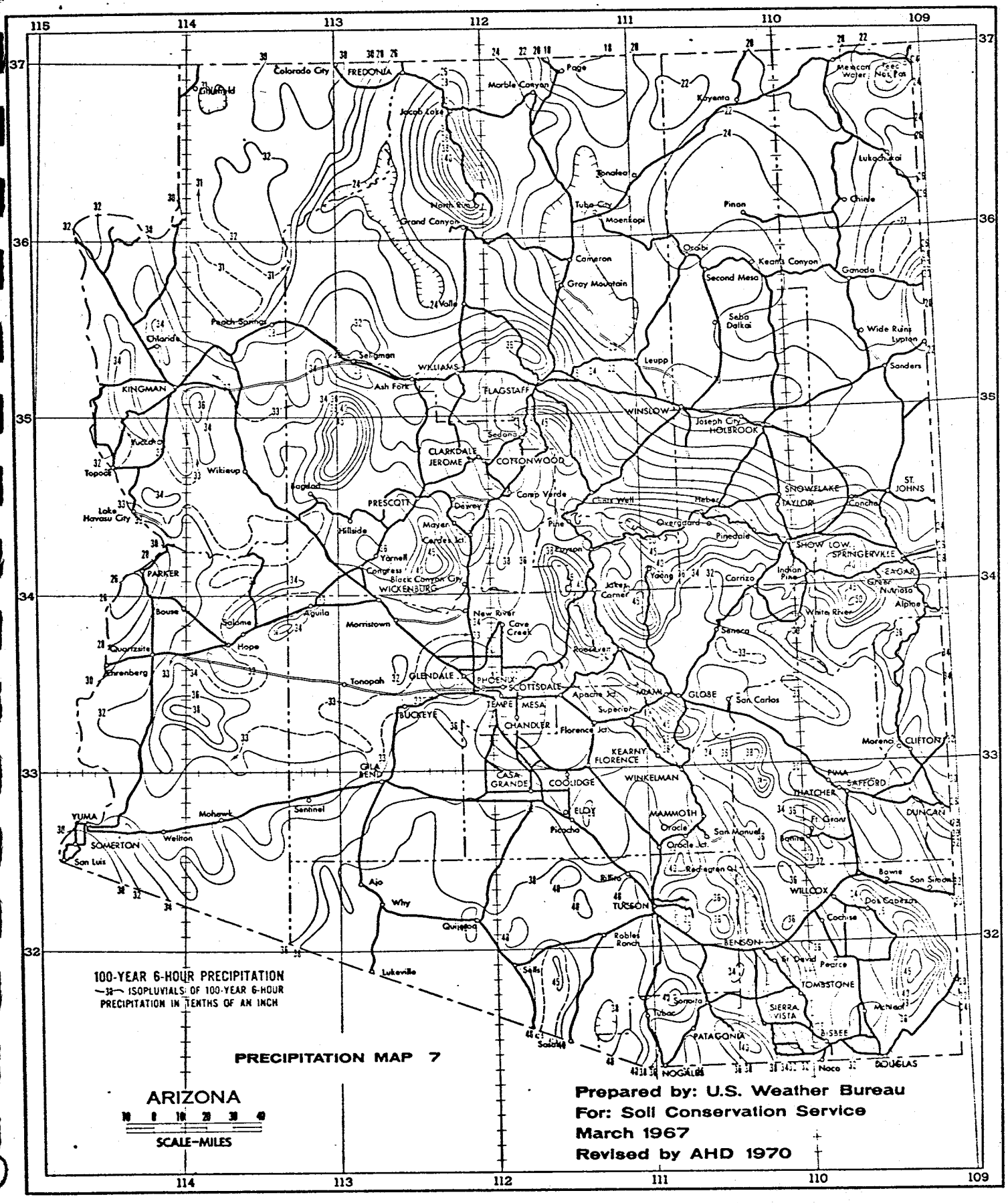

10-YEAR 24-HOUR PRECIPITATION
—28— ISOPLUVIALS OF 10-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 2
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

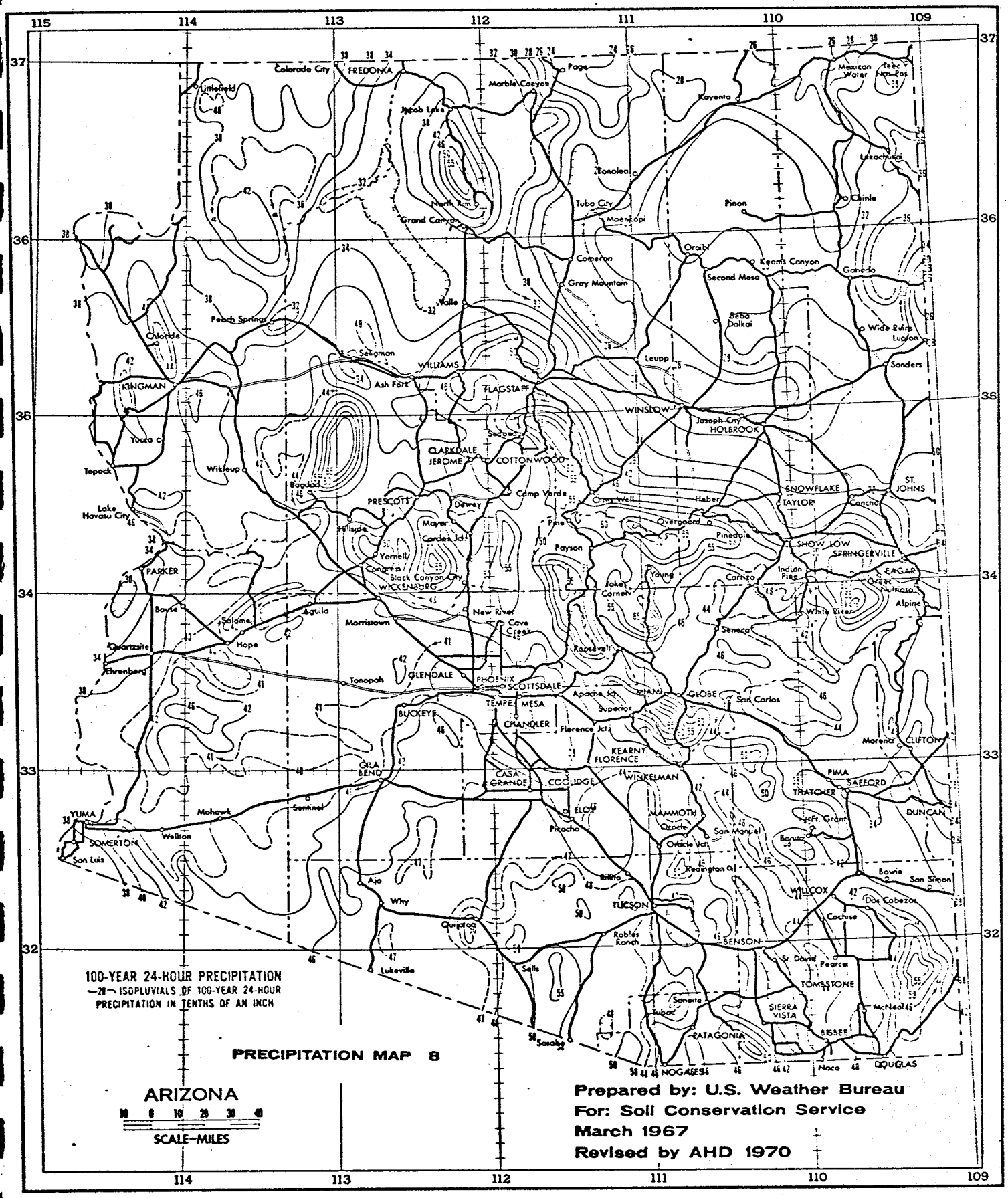

25-YEAR 6-HOUR PRECIPITATION
—28— ISOPLUVIALS OF 25-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 3
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


25-YEAR 24-HOUR PRECIPITATION
—38— ISOPLUVIALS OF 25-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 4
ARIZONA
SCALE—MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


50-YEAR 6-HOUR PRECIPITATION
—38— ISOPLUVIALS OF 50-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 5
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


50-YEAR 24-HOUR PRECIPITATION
—38— ISOPLUVIALS OF 50-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 6
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


100-YEAR 6-HOUR PRECIPITATION
—38— ISOPLUVIALS OF 100-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 7
ARIZONA
SCALE-MILES
Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970


115
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Colorado City
FREDONIA
Littlefield
Jacob Lake
Marble Canyon
Page
Kayenta
Mexican Water
Teec Nos Pos
Tonalea
Tuba City
North Rim
Grand Canyon
Moenkopi
Pinon
Chinle
Lukachukai
Cameron
Gray Mountain
Valle
Oraibi
Keams Canyon
Second Mesa
Ganado
Peach Springs
Bebe Dalkai
Wide Ruins
Lupton
Sanders
Leupp
Seligman
WILLIAMS
Ash Fork
FLAGSTAFF
WINSLOW
Joseph City
HOLBROOK
Sedona
CLARKDALE
JEROME
COTTONWOOD
Camp Verde
Chevelon
Haber
SNOWFLAKE
TAYLOR
ST. JOHNS
Concho
Overgaard
Pinedale
Chloride
KINGMAN
Yucca
Topock
Wikieup
Bagdad
PRESCOTT
Dewey
Mayer
Goodies Jct
Hillside
Yarnell
Congress
Black Canyon City
WICKENBURG
Lake Havasu City
PARKER
Payson
Pine
Strawberry
SHOW LOW
SPRINGERVILLE
EAGAR
Indian Pipe
Nutrioso
Alpine
White River
Joker Canyon
Young
Carrizo
Seneca
Bouse
Salome
Aguila
Morristown
New River
Cave Creek
Quartzsite
Hope
Ehrenberg
Tonopah
GLENDALE
PHOENIX
SCOTTSDALE
Roosevelt
Apache Jct
MIAMI
GLOBE
San Carlos
Superior
BUCKEYE
TEMPE
MESA
CHANDLER
Florence Jct
Morenci
CLIFTON
KEARNY
FLORENCE
GILA BEND
CASA GRANDE
COOLIDGE
WINKELMAN
PIMA
SAFFORD
THATCHER
YUMA
Mohawk
Sentinel
ELOY
Picacho
MAMMOTH
Oracle
Oracle Jct
San Manuel
Ft. Grant
DUNCAN
Bonita
SOMERTON
Wellton
San Luis
Redington Rd
Bowie
San Simon
Ajo
Why
Robles Ranch
TUCSON
WILLCOX
Dos Cabezos
Cochise
Quijotoa
BENSON
St. David
Pearce
Lukeville
Sells
TOMBSTONE
Sonoita
Tubac
SIERRA VISTA
McNeal
BISBEE
PATAGONIA
Sasabe
NOGALES
Naco
DOUGLAS
100-YEAR 24-HOUR PRECIPITATION
—28— ISOPLUVIALS OF 100-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH
PRECIPITATION MAP 8
ARIZONA
SCALE-MILES
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March 1967
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